Harmonic distortion

Single tone input signal frequency sweep at different power back off. Frequency range 125 MHz – 2 GHz.

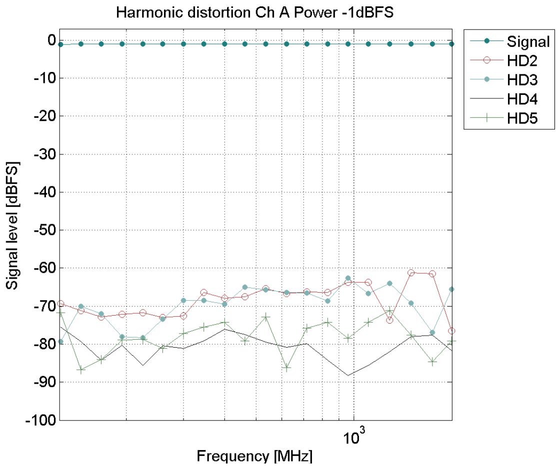

Figure 1: Harmonic distortion at –1 dBFS.

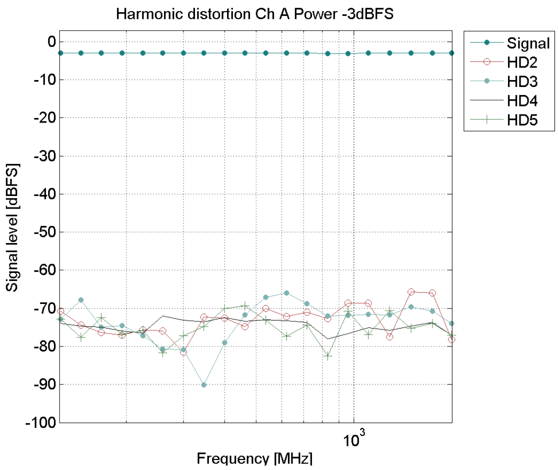

Figure 2: Harmonic distortion at –3 dBFS.

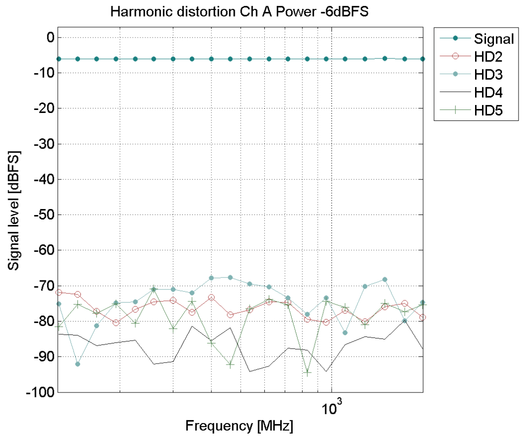

Figure 3: Harmonic distortion at –6 dBFS.

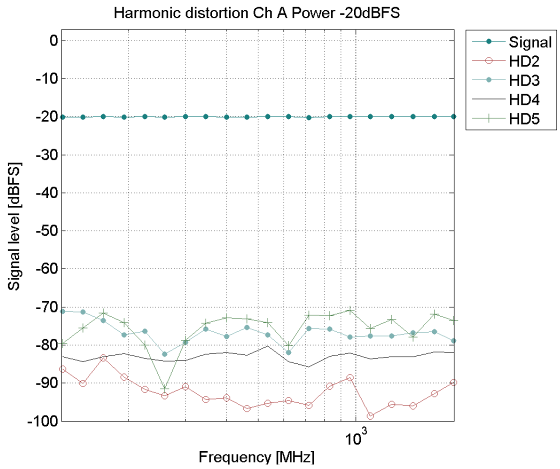

Figure 4: Harmonic distortion at –20 dBFS.

SNR

Single tone input signal frequency sweep at different power back off. Frequency range 125 MHz – 2 GHz.

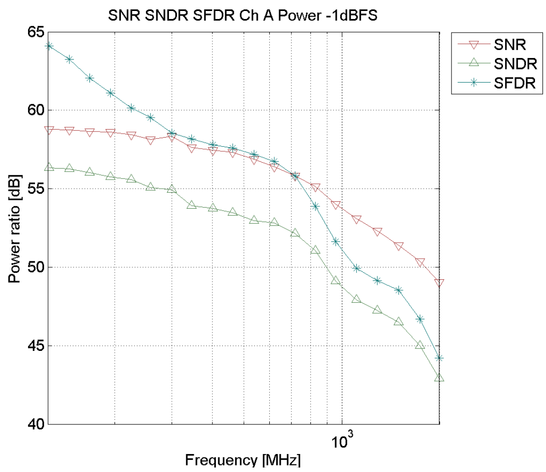

Figure 5: SNR SFDR SNDR at –1 dBFS.

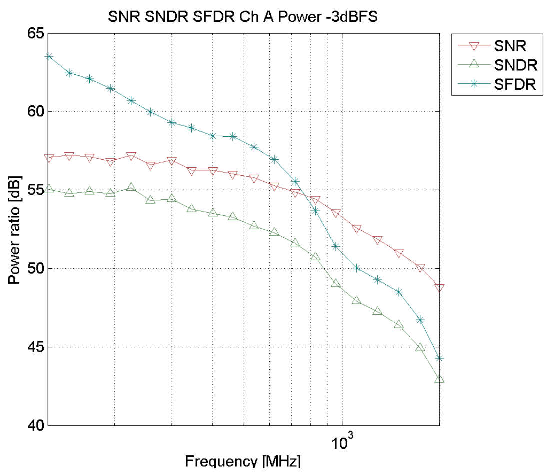

Figure 6: SNR SFDR SNDR at –3 dBFS.

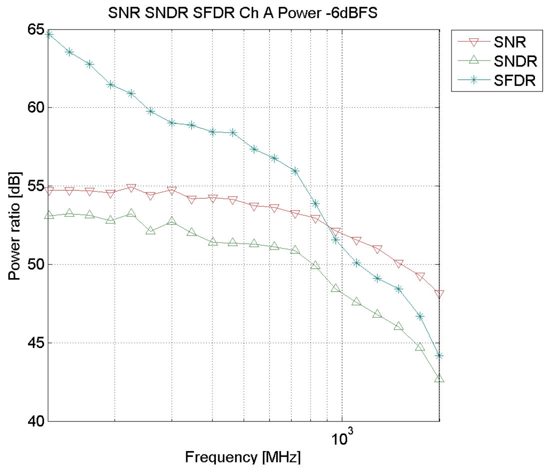

Figure 7: SNR SFDR SNDR at –6 dBFS.

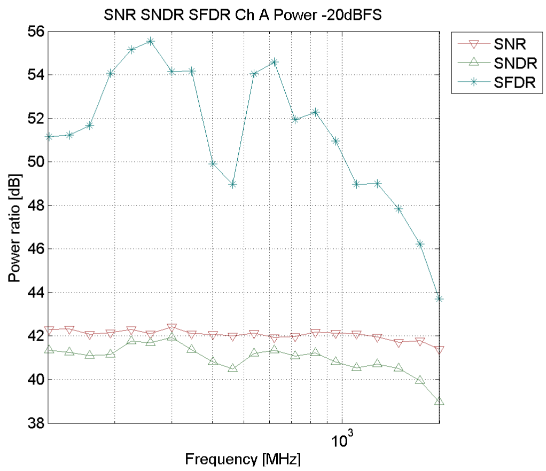

Figure 8: SNR SFDR SNDR at –20 dBFS.

Trigger input

The external trigger input is sampled with the sampling clock at 3.6 GSPS. The trigger is asynchronous. The signal is a square wave at 1.23456789 MHz which is not phase locked (thus drifting) to the sampling clock in the ADQ412-3G. The distribution of incoming sample edges is approximately flat within a sample period. To measure the actual time of the trigger, the signal is split and measured on Channel A, **Figure 9**. The edge as seen on Channel A is shown in **Figure 10**.

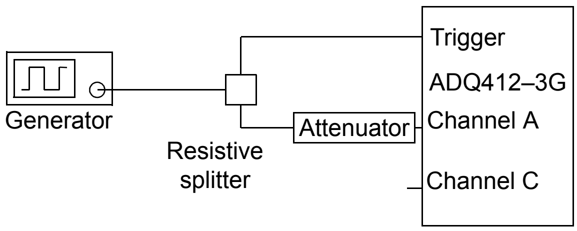

Figure 9: Model of external trigger set-up

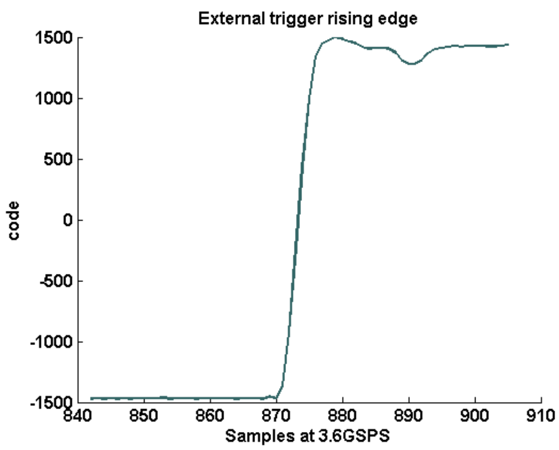

Figure 10: Trigger rising edge

The distribution of triggers is measured and shown in **Figure 11**. The sample boundaries (period = 277 ps) are marked. In an ideal case, the distribution would be rectangular within the 277 ps boundaries. However additive jitter on the trigger input will create the tails outside the boundaries.

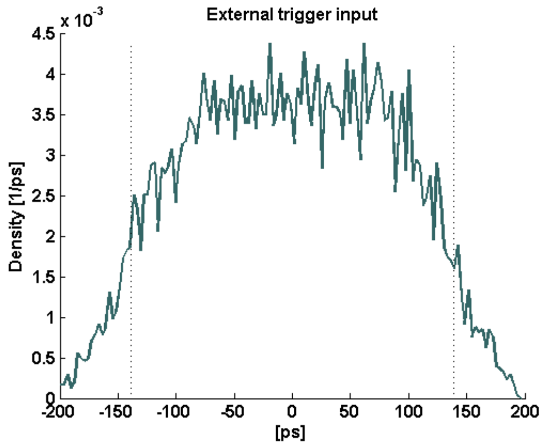

Figure 11: External trigger distribution

An approximation of the trigger jitter is found by looking at the distribution of the tails outside the sample boundaries, **Figure 12**. The RMS value of these tails is 24 ps, which is the jitter at the external trigger input. (The jitter on the Channel A reference sampling is in the order of 0.3 ps, so that contribution is neglected.)

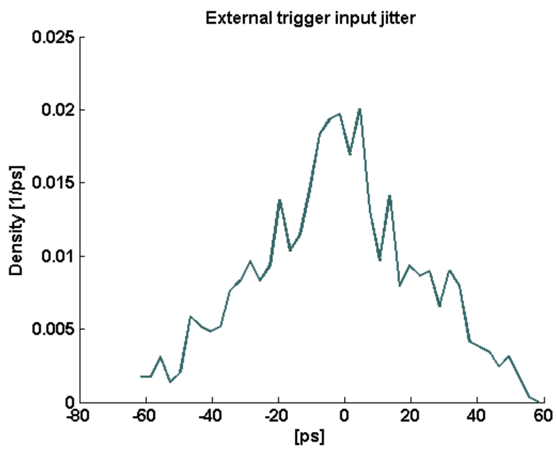

Figure 12: External trigger tails

Channel to channel jitter.

A square wave signal through a SLP-90 filter (5 th order cauer low pass) is split to two inputs and the times of the zero crossings are compared. By using every channel as reference, the cable delay can be compensated for. In Table 1 is raw data.

REFERENCE CHANNEL	COMPARE WITH CHANNEL A	B	C	D
A	–	–7.7	48	11
B	19	–	62	30
C	–30	–45	–	–25
D	4.9	–12	43	–

Table 1: Average time

The cables to the two inputs has to be taken into account. The model is that one of the branches has a delay, Figure 13. By measuring

DT + A – B = –7.7

DT + B – A = 19

The DT is found as

DT = (19 – 7.7) / 2 = 5.65 ps.

Doing this for all combinations give the result in Table 2. Ideally, all values for DT would have been the same. The deviation of 5 ps one measurement correspond to a cable length of 1 mm, and is judged to be accepted deviation.

The skew between the channels is found as

A – B = (–7.7 – 19) / 2 = 13.35 ps

The skew for different combinations is also listed in Table 2. The result is checked in by drawing the graph in Figure 14. By walking round each closed path in the graph and summing the values gives the result close 0, which is expected. The conclusion is the skew between channels is typically max 50ps.

EQUATION	MEASURED	CALC DT	SKEW
DT + A – B	–7.7	5.6	–13
DT + B – A	19		
DT + A – C	48	9	39
DT + C – A	–30		
DT + A – D	11	8	3.1
DT + D – A	4.9		
DT + B – C	62	8.5	53
DT + C – B	–45		
DT + B – D	30	9	21
DT + D – B	–12		
DT + C – D	–25	9	-34
DT + D – C	43		

Table 2: Skew calculation

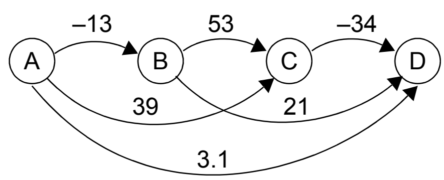

Figure 14: Delay between inputs.

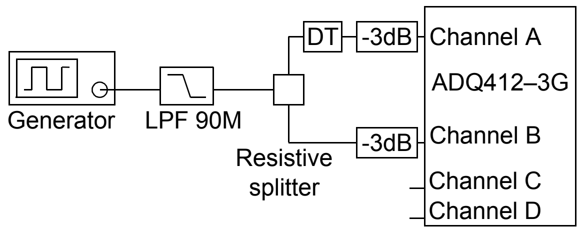

Figure 13: Model

Trigger output

The trigger output jitter is measured by connecting the trigger output to the Channel A input in 2 channel mode. 9 dB attenuation is used. The result is RMS jitter 13 ps, **Figure 15**. The jitter from the Channel A input of 0.3 ps is neglected.

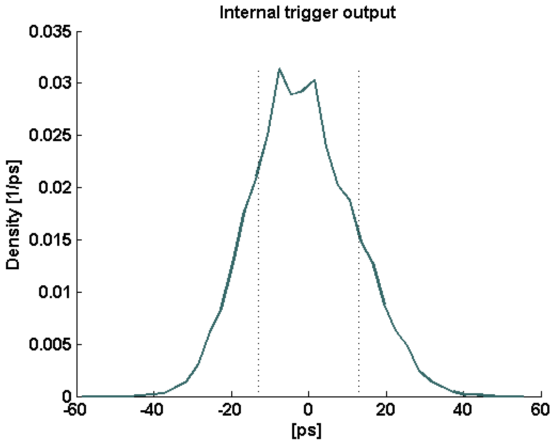

Figure 15: Internal trigger jitter measurement